CLAIM AMENDMENTS

Please amend the claims to read as provided in the following claim listing:

1.-41. (Canceled)

42. (Currently amended) A method for steering a downhole drilling apparatus with respect to a geological bed boundary in an earth formation, said drilling apparatus including an electromagnetic propagation logging tool having a tool axis; a first transmitter antenna disposed within a plane oriented at a first angle with respect to the tool axis; a second transmitter antenna spaced apart from said first transmitter antenna along the tool axis and disposed within a plane oriented at a second angle with respect to the tool axis; a first receiver antenna located at a first receiver location along said tool axis between said first and second transmitter antennas, said first receiver antenna being oriented at a third angle with respect to said tool axis, said third angle being different from said first and second angles; a second receiver antenna located at a second receiver location along said tool axis between said first and second transmitter antennas, said second receiver location being different from said first receiver location, said second receiver antenna being oriented at a fourth angle with respect to said tool axis, said fourth angle being different from said first and second angles; and a processor in communication with said first and second transmitter antennas and said first and second receiver antennas; said method comprising the steps of:

(a) transmitting a first transmitted electromagnetic wave into said formation using said first transmitter antenna, wherein said first transmitted electromagnetic wave induces a first electric current in said formation, and wherein said first electric current generates a first induced electromagnetic wave in said formation;

(b) transmitting a second transmitted electromagnetic wave into said formation using said second transmitter antenna, wherein said second transmitted electromagnetic wave induces a second electric current in said formation, and wherein said second electric current generates a second induced electromagnetic wave in said formation;

(c) receiving said first induced electromagnetic wave with said first receiver antenna thereby generating a first response signal based upon said first induced electromagnetic wave, said first response signal being proportional to the electrical resistivity of a portion of said formation;

(d) receiving said first induced electromagnetic wave with said second receiver antenna thereby generating a second response signal based upon said first induced electromagnetic wave, said second response signal being proportional to the electrical resistivity of a portion of said formation;

(e) receiving said second induced electromagnetic wave with said first receiver antenna thereby generating a third response signal based upon said second induced electromagnetic wave, said third response signal being proportional to the electrical resistivity of a portion of said formation;

(f) receiving said second induced electromagnetic wave with said second receiver antenna thereby generating a fourth response signal based upon said second induced electromagnetic wave, said fourth response signal being proportional to the electrical resistivity of a portion of said formation;

(g) sending said first, second, third, and fourth response signals to said processor;

(h) operating said processor to generate a first differential signal based on said first and second response signals;

(i) operating said processor to generate a second differential signal based on said third and fourth response signals;

(j) operating said processor to generate an output signal as a function of borehole depth based on said first and second differential signals, wherein said output signal is indicative of the relative position of said tool with respect to said geological bed boundary as said tool approaches said geological bed boundary, and wherein said output signal comprises the difference of said first and second differential signals; and

(k) controlling the drilling direction of said drilling apparatus in response to said output signal.

43. (Original) The method of claim 42 wherein:

said first differential signal comprises the phase difference between said first and second response signals; and

said second differential signal comprises the phase difference between said third and fourth response signals.

44. (Original) The method of claim 42 wherein:

said first differential signal comprises the amplitude ratio of said first and second response signals; and

said second differential signal comprises the amplitude ratio of said third and fourth response signals.

45. (Original) The method of claim 42 wherein:

said first differential signal comprises a phase shift resistivity value based on the phase difference between said first and second response signals; and

said second differential signal comprises a phase shift resistivity value based on the phase difference between said third and fourth response signals.

46. (Original) The method of claim 42 wherein:

said first differential signal comprises an amplitude attenuation resistivity value based on the amplitude ratio of said first and second response signals; and

said second differential signal comprises an amplitude attenuation resistivity value based on the amplitude ratio of said third and fourth response signals.

47. (Canceled)

48. (Currently amended) ~~The method of claim 42~~ A method for steering a downhole drilling apparatus with respect to a geological bed boundary in an earth formation, said drilling apparatus including an electromagnetic propagation logging tool having a tool axis; a first transmitter antenna disposed within a plane oriented at a first angle with respect to the tool axis; a second transmitter antenna spaced apart from said first transmitter antenna along the tool axis and disposed within a plane oriented at a second angle with respect to the tool axis; a first receiver antenna located at a first receiver location along said tool axis between said first and second transmitter antennas, said first receiver antenna being oriented at a third angle with respect to said tool axis, said third angle being different from said first and second angles; a second receiver antenna located at a second receiver location along said tool axis between said first and second transmitter antennas, said second receiver location being different from said first receiver location, said second receiver antenna being oriented at a fourth angle with respect to said tool axis, said fourth angle being different from said first and second angles; and a processor in communication with said first and second transmitter antennas and said first and second receiver antennas; said method comprising the steps of:

(a) transmitting a first transmitted electromagnetic wave into said formation using said first transmitter antenna, wherein said first transmitted electromagnetic wave induces a first electric current in said formation, and wherein said first electric current generates a first induced electromagnetic wave in said formation;

(b) transmitting a second transmitted electromagnetic wave into said formation using said second transmitter antenna, wherein said second transmitted electromagnetic wave induces a second electric current in said formation, and wherein said second electric current generates a second induced electromagnetic wave in said formation;

(c) receiving said first induced electromagnetic wave with said first receiver antenna thereby generating a first response signal based upon said first induced electromagnetic wave, said first response signal being proportional to the electrical resistivity of a portion of said formation;

(d) receiving said first induced electromagnetic wave with said second receiver antenna thereby generating a second response signal based upon said first induced electromagnetic wave, said second response signal being proportional to the electrical resistivity of a portion of said formation;

(e) receiving said second induced electromagnetic wave with said first receiver antenna thereby generating a third response signal based upon said second induced electromagnetic wave, said third response signal being proportional to the electrical resistivity of a portion of said formation;

(f) receiving said second induced electromagnetic wave with said second receiver antenna thereby generating a fourth response signal based upon said second induced electromagnetic wave, said fourth response signal being proportional to the electrical resistivity of a portion of said formation;

(g) sending said first, second, third, and fourth response signals to said processor;

(h) operating said processor to generate a first differential signal based on said first and second response signals;

(i) operating said processor to generate a second differential signal based on said third and fourth response signals;

(j) operating said processor to generate an output signal as a function of borehole depth based on said first and second differential signals, wherein said output signal is indicative of the relative position of said tool with respect to said geological bed boundary as said tool approaches said geological bed boundary and wherein said output signal comprises the ratio of said first and second differential signals; and

(k) controlling the drilling direction of said drilling apparatus in response to said output signal.

49.-62. (Canceled)

63. (New) A method for steering a downhole drilling apparatus, the method comprising:

inducing a first electromagnetic wave in a formation using a first transmitter antenna oriented at a first angle relative to a tool axis;

determining a first differential signal based on responses to the first electromagnetic wave by a first receiver antenna and a second receiver antenna, the receiver antennas each being oriented relative to the tool axis at an angle different than the first angle;

inducing a second electromagnetic in said formation using a second transmitter antenna;

determining a second differential signal based on responses to the second electromagnetic wave by the first and second receiver antennas;

obtaining a output signal from the first and second differential signals, wherein the output signal comprises a difference of said first and second differential signals or a ratio of said first and second differential signals; and

adjusting a drilling direction of said drilling apparatus based at least in part on said output signal.

64. (New) The method of claim 63 wherein:

said first differential signal comprises the phase difference between said first and second response signals; and

said second differential signal comprises the phase difference between said third and fourth response signals.

65. (New) The method of claim 63 wherein:

said first differential signal comprises the amplitude ratio of said first and second response signals; and

said second differential signal comprises the amplitude ratio of said third and fourth response signals.

66. (New) The method of claim 63 wherein:

said first differential signal comprises a phase shift resistivity value based on the phase difference between said first and second response signals; and

said second differential signal comprises a phase shift resistivity value based on the phase difference between said third and fourth response signals.

67. (New) The method of claim 63 wherein:

said first differential signal comprises an amplitude attenuation resistivity value based on the amplitude ratio of said first and second response signals; and

said second differential signal comprises an amplitude attenuation resistivity value based on the amplitude ratio of said third and fourth response signals.

68. (New) The method of claim 63 wherein said output signal comprises the difference of said first and second differential signals.

69. (New) The method of claim 63, wherein said output signal comprises the ratio of said first and second differential signals.